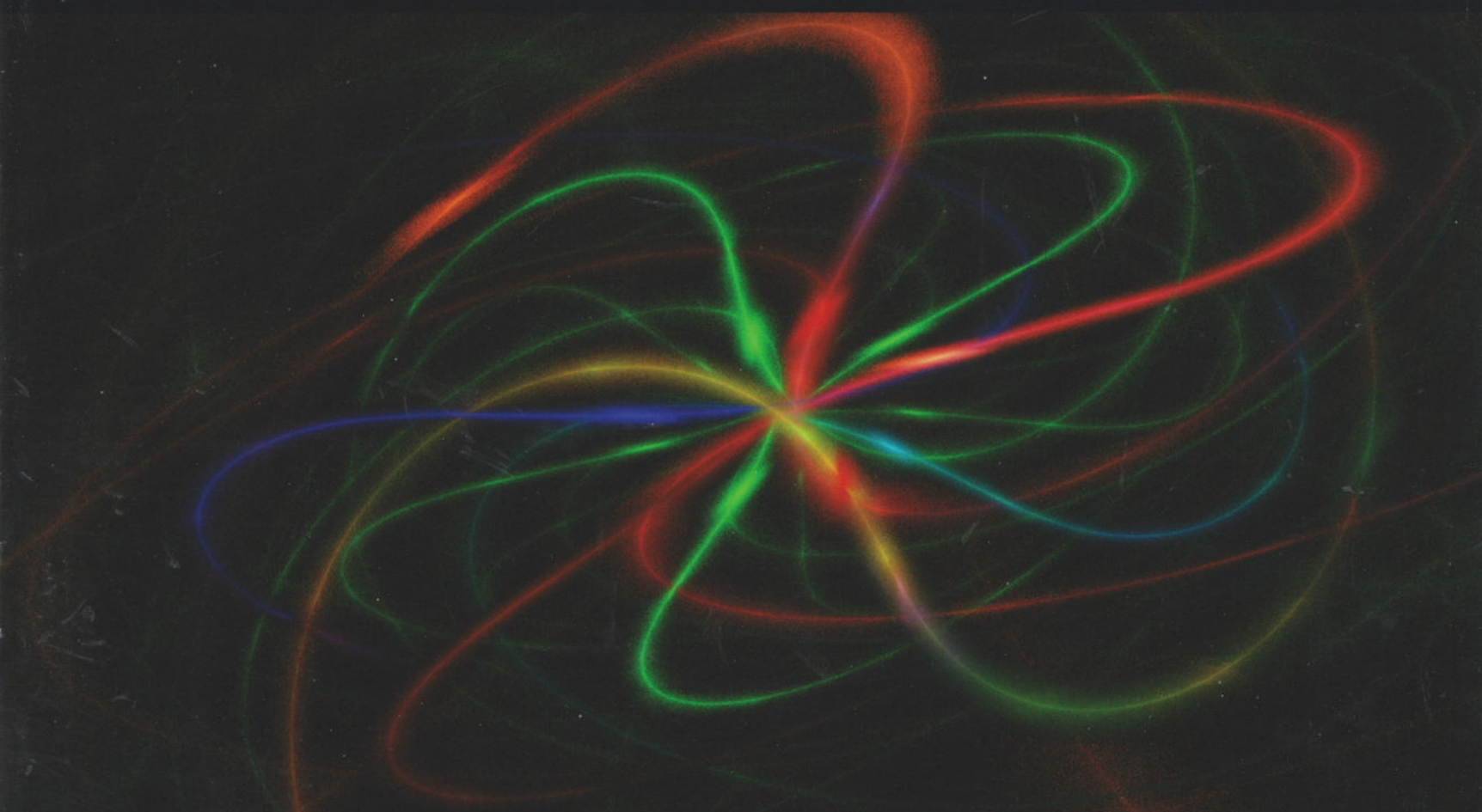
The Open University

MST125

Essential mathematics 2

MST125 Guide



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Essential mathematics 2

MST125 Guide

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Introduction

Welcome to MST125 *Essential mathematics 2*. We hope that you will find studying this module an enjoyable and rewarding experience.

Read this introduction and Section 1 of this MST125 *Guide* before you start working on the study units.

They contain important information about MST125, including what you need to do to prepare for studying it, and how it is assessed.

If you are studying MST125 at the same time as *Essential mathematics 1* (MST124), either starting at the same time or overlapping, then it is particularly important that you read Subsection 1.5.

This MST125 *Guide* contains three main sections.

- **Section 1 Study guide**: This tells you about the structure of MST125, what you need to do before and during your study of it, the support that you can expect to receive, and how you will be assessed.

  You should read this section as soon as possible, as it contains activities that you need to do to ensure that you are ready to begin MST125. When you have completed this section, you should start studying Book A as soon as possible, and by the official start date at the latest. (If you are studying MST124 and MST125 at the same time, then you must instead begin your study as described in Subsection 1.5 of this MST125 *Guide*.)
- **Section 2 Technology guide**: This gives detailed information about the computing and online components of MST125. You may wish to skim through this section now, and read it in more detail when you need to do so during your studies.
- **Section 3 Accessibility guide**: This section is primarily aimed at those who may have difficulties with one or more elements of MST125 because of a disability, for example.

The MST125 learning materials consist not only of the study texts that are sent to you, but also other essential components, such as the assignments, which are delivered through the MST125 website. You can access this website from your StudentHome page (see the Appendix, on page 50). It will open about two weeks before the official start date of MST125. The MST125 website and StudentHome are described in Subsection 1.2.

If you have recently studied MST124 or are currently studying it, much of the information in this *Guide* will already be familiar to you. In this case you should pay particular attention to Subsection 1.4, Assessment, and Subsection 1.5, Studying MST124 and MST125 together (if this subsection applies to you).

Keep this MST125 *Guide* to hand, as you may need to refer to it throughout your studies.

This MST125 *Guide* refers to many online sources of further information, such as websites and online documents. Details of where to find these are summarised in the Appendix.

1 Study guide

MST125 *Essential mathematics 2* builds on the mathematical ideas developed in *Essential mathematics 1* (MST124) and is designed to be studied either after MST124 or at the same time as it.

In MST125 you will study a wide range of topics from different areas of mathematics and learn how many of them can be applied to practical problems. Familiarity with these topics will provide you with a firm foundation for further studies in mathematics and other mathematically rich subjects such as physics and engineering.

1.1 Introduction to MST125

MST125 contains twelve study units. The main texts of the units are sent to you in five printed books: Books A, B, C and D and *Mathematical typesetting* (Unit 2). There are also three other texts that are sent to you as printed books: this MST125 *Guide*, the *Handbook* and the *Computer algebra guide*. These are described in more detail in Subsection 1.3. The eight printed books are all also available in electronic form on the MST125 website.

The titles of the units are listed below.

Book A	Unit 1	Key techniques
	Unit 2	Mathematical typesetting
	(Unit 2 is provided as a separate item.)	
	Unit 3	Number theory
Book B	Unit 4	Conics
	Unit 5	Statics
	Unit 6	Geometric transformations
Book C	Unit 7	Topics in calculus
	Unit 8	Differential equations
	Unit 9	Mathematical language and proof
Book D	Unit 10	Dynamics
	Unit 11	Eigenvalues and eigenvectors
	Unit 12	Combinatorics

The units also include online study materials, such as video clips, interactive practice quizzes and applets (computer demonstrations). More details of these are given in Subsection 1.3.

During your study of MST125 you will develop your abilities to study mathematics independently, to solve mathematical problems and to communicate mathematics. You will also develop your skills in using a computer algebra system to support your use and investigation of mathematics.

You will be assigned a tutor to support your study of the module.

1.2 What to do first

This section lists and gives details of activities that you should do before you begin your study of MST125. You should do these activities as soon as possible, so that you are ready to begin your study on the MST125 start date at the latest. You can find the start date in the MST125 description on the Study at the OU website, or from your StudentHome page or the MST125 website. Remember that the details of where to find all the websites mentioned in this MST125 *Guide* are given in the Appendix.

Depending on your previous background both in mathematics and as an OU student, you may need to allow several hours to complete these activities. You can do some of them only once the MST125 website has opened, which will be about two weeks before the MST125 start date, so you may need to leave those until then. To ensure that you don't forget to do any of the activities, you could mark the margin of this MST125 *Guide* with a tick next to each activity as you complete it.

Check your materials

Check that you have received all the items listed in the *Contents checklist* contained in your parcel. You may like to tick off each item as you unpack it. If anything is missing, follow the instructions on the *Contents checklist* to notify the OU, so that replacements can be sent to you.

Organise your study area

You are likely to need the following items each time you study MST125:

- the relevant MST125 book
- a computer with a connection to the internet (for details of computer requirements, see 'Check your computer' later in this subsection)
- paper, pens, pencils, an eraser and a ruler
- a basic scientific calculator (for details of suitable calculators, see 'Check your calculator' later in this subsection)
- the MST125 *Handbook* (this is described in Subsection 1.3)
- the MST125 *Computer algebra guide* (again, this is described in Subsection 1.3).

You should also keep this MST125 *Guide* to hand.

Organise your time

A typical student is likely to need on average about 9 hours a week to study MST125 and complete any associated work such as assignment questions and attending tutorials, but some people may need more time for some topics. You need to plan and arrange enough times during the week when you can study productively.

The weeks during which you should be studying each unit are set out in the study planner on the MST125 website. Most units are allocated two weeks of study time. The study planner also includes other key dates, such as the dates by which your assignments must be received (known as **cut-off dates**) and the dates of tutorials.

Information for joint MST124 and MST125 students

If you are studying *Essential mathematics 1* (MST124) with the same start date as MST125, then you should *not* study the MST124 and MST125 units on the dates shown on the main MST124 and MST125 study planners. Instead, you should follow the MST124 and MST125 joint study planner, which is available from the 'Resources' area at the top of the MST124 and MST125 websites. This is important because you will not be prepared to study many of the topics in MST125 if you have not already studied the related topics in MST124. The joint study planner ensures that you study the units of the two modules interleaved in the correct order.

The assignment cut-off dates shown on the MST124 and MST125 joint study planner are the same as those shown on the main MST124 and MST125 study planners.

If you are studying MST124 and MST125 together, then you will need on average 18 hours study time per week. In the joint study planner, most units are allocated a single week. In some weeks you will study an MST124 unit, and in others an MST125 unit. There is more information on studying MST124 and MST125 together in Subsection 1.5.

It is important to keep up with the schedule in the study planner as much as possible, or you could find that you have run out of time to study the units needed to complete an assignment before it has to be submitted. If possible, you should try to work ahead of the study planner. Then, if anything unexpected happens in other areas of your life, which disrupts your studying, you should be able to catch up fairly quickly.

Once you have access to the appropriate study planner, note the assignment cut-off dates and then plan your study carefully, taking account of your other commitments.

You may find it helpful to print the study planner and keep it handy, perhaps at the front of the folder where you keep your MST125 work, or pinned up somewhere so you can see it every day. The online MST125 study planner includes a link to a printable version.

The MST125 assignment cut-off dates are also displayed on your StudentHome page.

The final few weeks in the study planner are mainly reserved for revision in preparation for the examination. You should prepare your own revision schedule for these weeks.

There is further advice on how to study and manage your time in Subsection 1.7 of this *Guide*, and on the Skills for OU Study website.

Check your calculator

You will need a basic scientific calculator for some of the activities and assignments in MST125, and for the end-of-module examination. You should use the same calculator while you are studying MST125 as you intend to use in the examination, so that you become familiar with it.

A *scientific* calculator is one that includes function keys such as [sin], [cos], [tan] and [log]. A scientific calculator with advanced functionality, such as a programmable calculator or one that can perform algebraic manipulation, differentiation or integration, is not suitable for MST125, because it is not permitted in the examination. A calculator on a computer, mobile phone, tablet or similar device is not suitable either, again because it is not permitted in the examination.

Any calculator that is suitable for MST124 is also suitable for MST125. If you do not have a suitable calculator, then you should obtain one as soon as possible. A good option would be one of the *basic* scientific calculators from the Casio 'natural' range. These calculators are inexpensive and have various features that make them easy to use, such as the following.

- Two lines of display, so you can see the calculation that you input and the answer at the same time, as illustrated below.

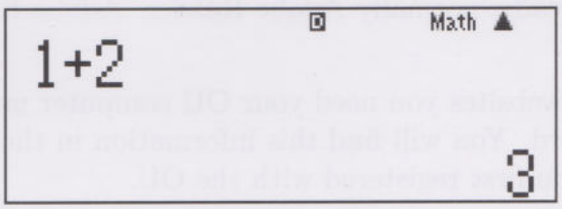

Figure 1 A modern two-line calculator display

- Input of calculations in the format that they are written. For example, you can calculate $\sin(30^\circ)$ by inputting [sin] [3] [0] [=]. On older calculators you need to input [3] [0] [sin] [=].
- Output of some answers as exact values, such as fractions, surds and multiples of π.

Recommended calculator models from this range are given on the MST125 website.

MST125 does not teach calculator skills, as you are expected to acquire these before studying the module. You might find it useful to have your calculator manual to hand. Calculator manuals are often available to view or download from the manufacturer's website. There is a link under the 'Assessment' area at the top of the MST125 website to a *Calculator guide*, which describes how to use calculators from the Casio 'natural' range.

Check your computer

Check that you have access to a personal computer of the required specification, as detailed in the MST125 description on the Study at the OU website. Any computer that is suitable for MST124 is also suitable for MST125.

You will need a basic knowledge of how to use your computer. You must be able to:

- navigate around a standard desktop on a computer
- use the mouse or keyboard to open and work with a document, folder or program
- create new folders and documents.

You should also check that you have a suitable web browser, and can use it to access the internet. Suitable browsers include Internet Explorer version 9 (which was released in 2011), any later version of Internet Explorer, and the latest versions of Firefox and Chrome.

Some older web browsers, such as Internet Explorer version 8 or earlier, are too out of date to allow you to access some of the MST125 online teaching materials, namely the applets (computer demonstrations). If you are using Internet Explorer version 8 or earlier, then you should download Firefox or Chrome. (Internet Explorer version 9 will probably be unsuitable for your computer.) These browsers are free to download and use. For more information on this issue, see Subsection 2.2.

You will need PDF viewer software installed on your computer, so you can view the assignment booklets, for example. Most computers have such software installed already, normally Adobe Reader. Adobe Reader is free to download and use.

To access many OU websites you need your OU computer username (OUCU) and password. You will find this information in the letter that you received when you first registered with the OU.

There is useful advice on using a computer on the Skills for OU Study website, and in the online OU Computing Guide. In particular, the OU Computing Guide includes links to the OU Computing Codes of Conduct, which explain your responsibilities in using OU online resources.

There are further details of how to use your computer for MST125 in Section 2, Technology guide.

Check your mathematical skills

Before you start MST125 you should make sure that your previously acquired mathematical skills are at a good level, so you will be able to study the module successfully.

Information for joint MST124 and MST125 students

If you are studying MST124 at the same time as MST125, then you should prepare for MST125 in the way described in the appropriate part of Subsection 1.5, and not as described below.

Since MST125 builds on the mathematics studied in MST124, it is important that you can work fluently and correctly with the skills taught in MST124 before starting MST125.

Unit 1 of MST125 revises some key techniques from MST124 that you will need in your study of MST125. You should try to work through this unit as thoroughly as you can, so that you feel confident with the mathematical skills needed for MST125. However, you may not have time to carefully work through the whole unit, as it covers quite a lot of topics, so you should use the quizzes at the start of each section of Unit 1 to help you identify the areas that you need to revise most.

If it is some time since you studied MST124 and you have lost familiarity with the topics covered, then you should plan to allow extra time for studying this unit.

You should begin studying Unit 1 as soon as possible after you have finished working through this section. You may have already started work on it, as it is available on the Mathematics and Statistics programme website. Once you have finished Unit 1, you should continue working through the other units, as soon as you have access to them, according to the study planner.

If you find that a lot of the material in Unit 1 is difficult, or new to you, then you should contact your OU Student Support Team as soon as possible. See your StudentHome page for details under the Help Centre section.

Access StudentHome and the MST125 website

Connect to the internet using a web browser, and have a look at your Open University StudentHome page. (See the Appendix for details of where to find it.) This page provides access to all the websites that you need as a student at the OU.

Follow the various links provided on your StudentHome page, and the tabs across its top, to make sure that you can find the following:

- your individual profile (please check that your contact details recorded here are correct)
- your study record for MST125 (and any other current modules)
- the extensive range of OU study support resources (such as the Help Centre and OU Computing Guide)
- The MST125 website (this will open about two weeks before the MST125 start date)
- your MST125 tutor's details (these should appear shortly before the MST125 start date).

The OU Computing Guide contains information on StudentHome, including a short video demonstrating the features of StudentHome, which you may like to watch.

Now have a look at the MST125 website, if it is open. This website provides you with an online 'home' for almost everything that relates to studying MST125.

The main page of the MST125 website features the MST125 study planner. You can access online items that are part of a study unit, such as video clips and practice quizzes, by clicking on the relevant link in the study planner. Many of these items are also available via links within the different sections across the top of the MST125 website homepage.

At the top of the page is a 'News' section. Any urgent messages, such as updated information about assignments or the examination, will be posted here.

The MST125 online forums are available in the 'Forums' area from a link at the top of the website. These are group discussion areas where you and other MST125 students can post and read messages. You should check that you can access these forums. At least one should open about a week before the MST125 start date. There are further details about the forums in Subsection 2.5.

The MST125 website also includes electronic versions of all the MST124 unit texts, for reference.

Whichever page of the MST125 website you are viewing, you can always return to the main page by clicking the link beginning 'MST125' in the top-left hand corner of the page.

You should visit the MST125 website at least twice a week, to check for the latest news and information.

Install the computer algebra system

As part of your study of MST125 you will develop further skills in using the computer algebra system (CAS) introduced in MST124. These skills are taught in the MST125 *Computer algebra guide*, which is sent to you as a printed book and is also available in electronic form on the MST125 website.

You may already have the CAS installed on your computer from MST124. You should work through the Introduction and Section 1 of the *Computer algebra guide* as soon as possible, either to check that you already have the system installed on your computer or to install it so it is ready for when you need it.

The study units tell you when to use the CAS and/or the *Computer algebra guide*, and Unit 1 includes an opportunity for you to revise the CAS skills introduced in MST124, in case it has been some time since you studied that module, or you have never studied it.

1.3 Components of MST125

The main components of the MST125 learning materials are listed below (some of them have been mentioned already):

- twelve study texts, in five printed books: Books A, B, C and D and *Mathematical typesetting* (Unit 2)
- the *Handbook*, a printed book
- the *Computer algebra guide*, a printed book
- applets, available on the website
- tutorial clips and videos, available on the website
- interactive practice quizzes, available on the website
- exercise booklets (for some units), printable from the website.

More details about these components are provided below.

Study texts for Unit 1 and Units 3–12

The study texts for Unit 1 and Units 3–12 are in Books A, B, C and D. These are printed books that are sent to you. The texts for the individual units are also available in electronic form on the MST125 website.

Each of these study texts is structured in a similar way, and consists of a mixture of explanations of the mathematics, worked examples and activities. The examples show you how to do the mathematics and how to set out your working, and the activities ask you to do some mathematics yourself.

As you read through an explanation or example, you should try to make sure that you understand each step, and how it follows from the previous steps, without losing track of the overall objective. You should work through each activity carefully, and try not to skip any activities or activity parts, because the only effective way to learn mathematics is to try it for yourself. There are solutions to the activities at the end of each unit, which you should use to check your answers, or to obtain a hint if you are stuck. You will probably want to make notes for yourself as you study. There is further advice on study techniques in Subsection 1.7.

Within each unit text, the key facts and strategies are highlighted in green boxes like the one below, so you can refer to them easily.

Fundamental theorem of calculus

Suppose that f is a continuous function whose domain contains the numbers a and b, and that F is an antiderivative of f. Then

$$\int_a^b f(x)\,\mathrm{d}x = F(b) - F(a).$$

You will also see blue boxes like the one below, which describe some of the rich history of mathematics, or contain other interesting items.

'The calculus is the greatest aid we have to the appreciation of physical truth in the broadest sense of the word.'

William Fogg Osgood (1864–1943), *Bulletin of the American Mathematical Society* (1907), vol. 13, p. 467.

At some points in the unit texts you will notice one of the three icons shown in the margin.

The first icon appears next to some activities. It indicates that you need to use the computer algebra system (CAS) in the activity, as directed. Some of these activities involve working through substantial sections of the *Computer algebra guide*.

The second icon also appears next to some activities. It represents the internet, and indicates that you need to use an *applet* to investigate a mathematical concept in the activity, as directed. The applets are available on the MST125 website.

The third icon appears next to many worked examples, and occasionally next to a piece of text. It represents a 'play' button. Where the icon appears next to a worked example, it indicates that the example has an associated *tutorial clip*, a short video in which a tutor explains the worked example. Where it appears elsewhere, it indicates a piece of text that has an associated short video, other than a tutorial clip.

These components of MST125 are explained in more detail later in this subsection.

Some units have additional associated material on the MST125 website, such as more detailed or alternative explanations of certain topics.

The MST125 materials have been carefully checked, but occasionally updates are needed or errors are discovered. The necessary corrections, which are known as *errata*, are provided from a link in the 'Resources' area of the MST125 website. You should check the errata as soon as possible, and correct your printed materials.

Mathematical typesetting (study text for Unit 2)

Mathematical typesetting is sent to you as a printed book, and is also available in electronic form on the MST125 website.

It is the study text for Unit 2, which is rather different from the other units. In this unit, instead of learning mathematical ideas and techniques, you will learn how to produce properly typeset mathematics, similar to the mathematics presented in the study units. *Mathematical typesetting* contains teaching material for each of three different software systems that you can use to typeset mathematics, but you have to study the material for only *one* of these three systems. The book includes information to help you choose the one that is the most appropriate for you.

The ability to typeset mathematics will enable you to present your mathematics professionally and attractively, which may be important if you use mathematics elsewhere or are planning a mathematical career.

You may also wish to typeset your solutions to assignment questions. However, you are not required or expected to do this, except for Unit 2. You may find that typesetting your solutions takes you longer than handwriting them would, or that typographical errors lead to you losing marks for a typeset assignment solution that you would not have lost for a handwritten one. Before embarking on typesetting your assignment solutions, you should think carefully about whether this is the best option for you. In particular, you should not spend time on typesetting assignment solutions at the expense of spending time on the mathematics in MST125.

MST125 Handbook

The MST125 *Handbook* is a printed book that is sent to you. Like all the printed materials, it is also available in electronic form on the MST125 website.

The *Handbook* should be your constant study companion. It summarises the key ideas, techniques and formulas in each unit. It also includes summaries of all the MST124 study units, for reference. You can annotate it with your own notes. You should use it throughout your studies, so you become familiar with its layout.

You are allowed to take your *Handbook* (the copy that was sent to you), with your added annotations, into the end-of-module examination.

There are restrictions on the sorts of annotations that are permitted on the copy of the *Handbook* that you take into the examination. You can write notes of any sort on the pages in pencil or pen, about any mathematical topic that you wish, but you may not include additional pages, replace pages or add sticky notes or index tabs. These restrictions are formally set out in the *Examination Arrangements* booklet, which will be made available to you shortly before the examination.

It is a good idea to initially use pencil or sticky notes for your annotations, until you are confident about which annotations are the most useful. You must check that you have removed all sticky notes before the examination.

Although you can take the *Handbook* into the examination, you should still aim to learn as much of the module material as you can. You should find that you start to remember things as you practise the mathematics and look up items in the *Handbook*. Re-reading parts of the units will also help. The more you can remember, the easier and quicker you will find it to study the MST125 materials, do the assignment and examination questions, and study further modules with mathematical content.

If you are studying MST124 at the same time as MST125, then you should discard your MST124 *Handbook* and instead use the MST125 *Handbook* for both modules. It contains everything in the MST124 *Handbook*, as well as summaries of the MST125 material. You can take the MST125 *Handbook* into both the MST124 and MST125 examinations.

MST125 Computer algebra guide

The MST125 *Computer algebra guide* teaches you how to use the computer algebra system (CAS) for many of the mathematical topics taught in MST125.

At some points in the units you are directed to work through sections of the *Computer algebra guide*. You do not need to read sections of the *Computer algebra guide* until you are directed to do so.

You should also find that the *Computer algebra guide* is useful for reference when you do activities that ask you to use the CAS to do some mathematics. In particular, for each such activity the *Computer algebra guide* contains details of how to use the CAS for the mathematics in the activity, for you to look at if you get stuck or need a hint.

Each point in a unit where you are asked to use the CAS is indicated by an icon in the margin of the text, as shown here.

Applets

Several MST125 units include small interactive computer applications, known as *applets*, which are designed to enhance your understanding of mathematical ideas. For example, the applet shown in Figure 2 allows you to investigate a property of parabolas.

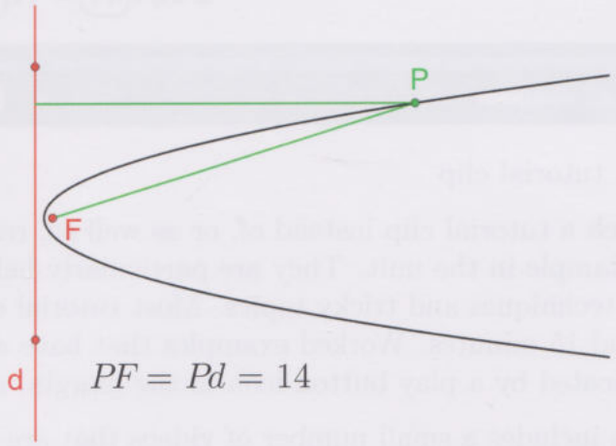

Figure 2 An applet

The applets are used in activities that ask you to investigate mathematical concepts. Each such activity is indicated by an icon in the margin of the text, as shown here. Each applet includes on-screen instructions.

You can access the applets from the MST125 website, and you can also download them to use offline. There are further details about using the applets in Subsection 2.2.

Tutorial clips and videos

Many of the worked examples in the units have an associated *tutorial clip*. This is a short audio-visual presentation of the worked example. In it you will see a tutor work through the example, as they would in a tutorial, explaining each step as they go. Figure 3 shows an image of a tutorial clip.

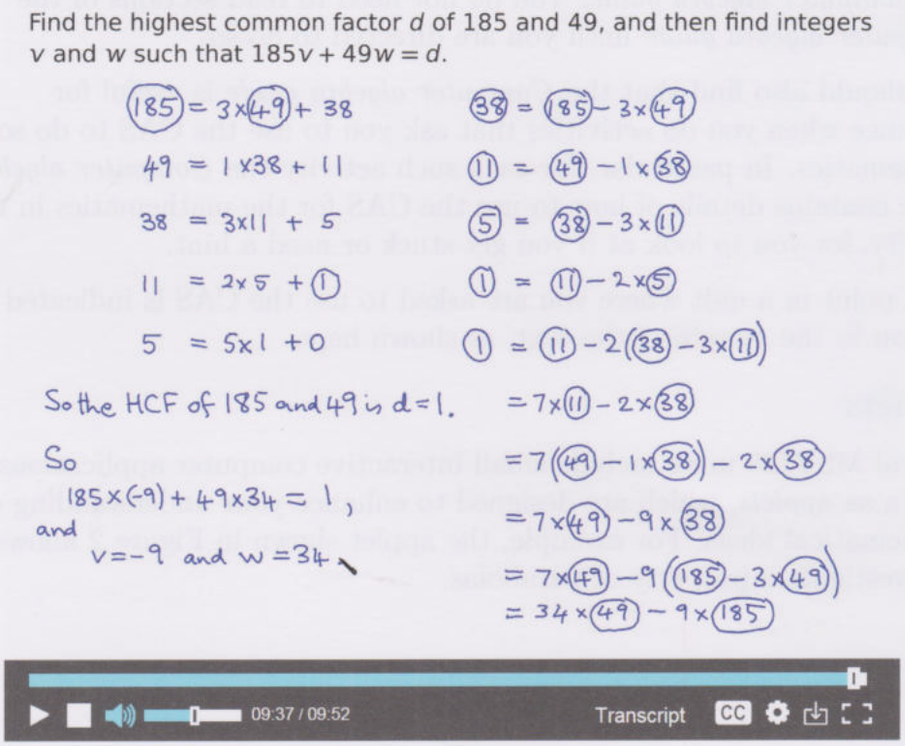

Figure 3 A tutorial clip

You can watch a tutorial clip instead of, or as well as, reading through the associated example in the unit. They are particularly helpful for complicated techniques and tricky topics. Most tutorial clips run for between 1 and 15 minutes. Worked examples that have associated tutorial clips are indicated by a play button icon in the margin, as shown here.

MST125 also includes a small number of videos that are not tutorial clips. These give additional background information on certain topics. They are mentioned individually in the units, at points indicated by the play button icon.

You can access the tutorial clips and videos from the MST125 website, and you can also download them to view offline. There are further details about using them in Subsection 2.3.

Practice quizzes

Most study units have an associated interactive practice quiz, which helps you consolidate your learning by trying out your skills and knowledge. It is usually most effective to try the practice quiz as you come towards the end of studying the unit. The practice quizzes also provide a good way for you to prepare for your assignments and to revise topics in preparation for the examination. Figure 4 shows an example of a practice quiz question.

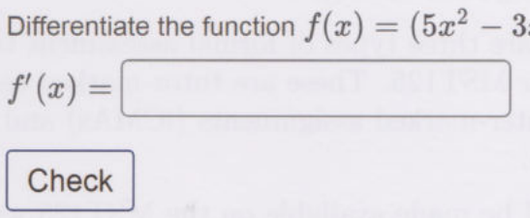

Figure 4 A practice quiz question

Your marks for a practice quiz do not count towards the your final result for MST125. Your tutor has access to the marks that you obtain, the questions that you are asked and the answers that you give, though there is no expectation that he or she will look at these.

Whenever you work on a practice quiz, you should have your calculator, the *Handbook*, paper, and a pen or pencil with you, since for most questions you will need to do some working. You may also find it helpful to have the relevant study text to hand.

You can do each practice quiz as many times as you like. The questions will usually be different each time, and different from the questions that other students are given.

You can attempt each question up to three times. After each attempt, you will receive immediate computer-generated feedback on your answer, and a reference to the relevant part of the study materials. Your marks for the question decrease with each incorrect attempt.

If you want to discuss the details of a practice quiz question with your tutor, please be prepared to give your tutor the details of the question.

You can access the practice quizzes from the MST125 website. There is further information about using them in Subsection 2.4, including details of the syntax that you need to use to input algebraic answers.

Exercise booklets

Some of the study units also have an associated exercise booklet, which contains additional questions and their solutions, for you to use to help consolidate your learning. The exercise booklets are available from the MST125 website, both in the study planner and in the 'Resources' area.

1.4 Assessment

Assessment and feedback are essential parts of learning. You need constructive feedback to enable you to improve your performance in future work.

The activities in the units, the practice quizzes and the exercise booklets all give you opportunities for *self-assessment*, to help you check your understanding and reinforce your learning.

In addition to these, there are three types of formal assessment that count towards your final result for MST125. These are tutor-marked assignments (TMAs), interactive computer-marked assignments (iCMAs) and the end-of-module examination.

The TMAs and iCMAs will be made available on the MST125 website at appropriate times during your studies – they will not all be available at the beginning of MST125. The dates by which you must submit these assignments, known as **cut-off dates**, are given in the MST125 study planner and also on your StudentHome page. You should note these important dates now, if you have not already done so.

You must access the TMAs and iCMAs from the MST125 website. You will not be sent paper copies of assignments.

Most students find it best to start working on the assignment questions for each unit fairly soon after studying the unit. It is usually not a good idea to defer starting work on an assignment until close to the cut-off date. This is because you may need time to revise some topics or contact your tutor with questions, and you are unlikely to produce your best work if you are under time pressure. Also, something unexpected might happen near the cut-off date, so you should allow some contingency time.

The Open University's general rules and regulations about submitting assignments and sitting examinations are described in the *Assessment Handbook*, which is available from your StudentHome page.

Details about the TMAs, iCMAs and end-of-module examination are given below, followed by information about how your overall final result is calculated.

Tutor-marked assignments (TMAs)

There are three assignments for which you must send written answers to your tutor. These assignments are known as **tutor-marked assignments**, or **TMAs**. Your tutor will mark your answers, and provide you with feedback on them.

Before you start work on the first TMA, you must read the document 'Instructions for preparing and submitting TMAs', which is available from the MST125 website.

Table 1 sets out which units are assessed in which TMAs.

Table 1 Units covered in TMAs

TMA	Units covered
TMA 01	2, 3, 4, 5
TMA 02	6, 7, 8
TMA 03	9, 10, 11

Unit 1, which revises material taught in MST124, is not assessed in any specific MST125 TMA, but the techniques that it covers are needed throughout the other TMAs, and are implicitly assessed in these. Unit 12 is not assessed in a TMA, but has more assessment by iCMA than the other units.

The TMAs will be available to download from the MST125 website although they won't all be available at module start. You are advised to print out each TMA, to make it easier to work on over a period of time.

The cut-off date for each TMA is the last date on which your tutor will normally accept your work for marking. Your tutor may be able to grant you an extension to the cut-off date for TMA 01 or TMA 02 if there are reasons why you are unable to meet the normal deadline. If you have problems in meeting a TMA deadline then you should contact your tutor as soon as possible. An extension for the final TMA (TMA 03) is not normally allowed.

The TMAs assess not just your mathematical abilities, but also your ability to communicate written mathematics. Some marks, known as *good mathematical communication* (GMC) marks, are allocated for this. There is guidance on writing mathematics well in Unit 1 of MST124, which is available from the MST125 website. The solutions to the activities and examples given in the units are examples of well-written mathematics.

The feedback on your TMA that your tutor provides will usually indicate what you have done well, point out any misunderstandings and errors, and make suggestions for improving your future work. This feedback is an important part of the learning process. You should read it carefully and act on it to improve your work in later assignments and in the examination.

Interactive computer-marked assignments

There are four assignments for which you must input your answers online. These assignments are known as **interactive computer-marked assignments**, or **iCMAs**. They are similar to the practice quizzes, but your marks for them count towards your final result.

It is strongly recommended that you work through the practice quiz for each unit, so that you are well prepared for the iCMA questions and familiar with the correct way to input your answers.

Table 2 sets out which units are assessed in which iCMAs.

Table 2 Units covered in iCMAs

iCMA	Units covered
iCMA 41	3, 4
iCMA 42	5, 6, 7
iCMA 43	8, 9, 10
iCMA 44	11, 12

Unit 1 (revision of MST124) is not assessed in any specific MST125 iCMA, but is implicitly assessed throughout the iCMAs. Unit 2, *Mathematical typesetting*, is not assessed in an iCMA.

The iCMAs will be available from the MST125 website and will appear as the module progresses. As with the practice quiz questions, whenever you work on iCMA questions, you should have your calculator, the *Handbook*, paper, and a pen or pencil with you. You may also want to refer to the relevant study texts.

Before you start work on each iCMA, you should read the instructions at the beginning of it. You will be required to confirm that the answers that you submit for the iCMA are all your own work.

Each iCMA will be available for you to work on for several weeks. You do not have to complete all the questions in an iCMA in one session; you can answer a few questions at a time, in any order. Your answers will be automatically saved whenever you move to a different question. You can return to any question and change your answers, at any time before you submit the iCMA.

To submit an iCMA, you click its 'Submit all and finish' button. You should submit each iCMA before 23:59 (UK time) on its cut-off date, even if you have not answered all the questions. If you do not submit the iCMA by 23:59 on the cut-off date, but you have answered at least one question, then you will have an additional seven days to submit the iCMA. During this time you will not be able to answer any further questions, nor change any existing answers.

No extensions to iCMA deadlines are permitted under any circumstances.

Please note the following important points.

- You can submit each iCMA *only once* (by clicking the 'Submit all and finish' button). So take care not to submit the iCMA until you are satisfied with your answers to all the questions.
- For your answers to an iCMA to count towards your final result, you *must submit* the iCMA.

You are strongly advised to attempt all of the questions in an iCMA, and to resist the temptation to guess answers, unless you are very short of time.

Once you submit an iCMA, you will receive computer-generated feedback on your answers. You can read the feedback again later by revisiting the iCMA. It will be available at least until the end of the module. Your official score for the iCMA will be displayed on your StudentHome page soon after the cut-off date.

Your iCMA questions will not be exactly the same as those of other students, but they will be on the same topics and of the same level of difficulty. As with the practice quizzes, your tutor has access to your iCMA marks, the questions that you were asked and the answers that you gave, but there is no expectation that he or she will look at these. If you want to query an issue about a particular iCMA question with your tutor, then please be prepared to give your tutor the details of the question.

There are further details on iCMAs in Subsection 2.4.

End-of-module examination

Details of the format of the end-of-module examination, along with a specimen examination paper and sample solutions, are available from the 'Examination' link in the 'Assessment' area of the MST125 website.

A document entitled 'How to prepare for and succeed in examinations in mathematics and statistics' is available from the same area of the MST125 website.

You should read all of these important documents carefully, well before the end of the module. However, it is a good idea to use the specimen examination paper to practise completing the paper, unseen, in the allotted time, so you might prefer not to look at it, or to only skim it, until you are ready to do this. You should make sure that you are familiar with the format of the paper, and the method for recording your answers, before you sit the real examination.

Details of the date, time and venue of the examination will be provided on your StudentHome page, a few months before the end of the module.

You should begin revising the module material in preparation for the examination as soon as you have finished the final unit. Helpful ways to revise can include reading the *Handbook* unit summaries, reading the notes that you have made, re-reading parts of the units that you have forgotten, making summary notes, reading the feedback from your tutor, doing the practice quizzes and exercise booklets, and perhaps re-doing some of the activities in the units. The most important part of your revision is to practise doing questions similar to those that you can expect to encounter in the examination. Towards the end of your period of revision you should practise doing the specimen paper in the allotted time. There is more advice in the 'How to prepare for and succeed in examinations in mathematics and statistics' document, which is available from the MST125 website.

Your knowledge of the computer algebra system and of mathematical typesetting are not assessed in the end-of-module examination.

Your final result

Your overall result for MST125 is based on the following two scores.

- Your **overall continuous assessment score** (**OCAS**). This is the weighted average of the scores that you obtain in the three TMAs and the four iCMAs. The weightings are given in Table 3.
- Your **overall examinable component score** (**OES**). This is the score that you achieve in the examination.

Table 3 Weightings for your overall continuous assessment score (OCAS)

Assignment	Units covered	OCAS Weighting
TMA 01	2, 3, 4, 5	25%
TMA 02	6, 7, 8	25%
TMA 03	9, 10, 11	25%
iCMA 41	3, 4	4%
iCMA 42	5, 6, 7	7%
iCMA 43	8, 9, 10	7%
iCMA 44	11, 12	7%

Note that if your score on any TMA or iCMA is lower than your calculated OCAS, then your score for up to one TMA and up to one iCMA will be substituted, to your advantage, and your OCAS recalculated, as explained in the *Assessment Handbook*.

Based on your OCAS and your OES, you will be awarded one of the following results:

- Pass 1 (distinction)
- Pass 2
- Pass 3
- Pass 4
- Fail

For you to be awarded a Pass 1, Pass 2, Pass 3 or Pass 4 result, your OCAS and your OES must *separately* reach thresholds that are determined by the MST125 Examination and Assessment Board for that result.

Normally,

- for a Pass 1 (distinction) you must achieve at least 85% for OCAS and at least 85% for OES
- for a Pass 2 you must achieve at least 70% for OCAS and at least 70% for OES
- for a Pass 3 you must achieve at least 55% for OCAS and at least 55% for OES
- for a Pass 4 you must achieve at least 40% for OCAS and at least 40% for OES.

For more details on how your overall result is calculated, see the *Assessment Handbook*.

Your assessment record

Your assessment record, which you can find on your StudentHome page and also via the MST125 website, lists your scores for the assignments to date. From your assessment record you can also access the Assessment Calculator, which helps you determine how you are progressing with your assignment scores, and see the effect of any substitution.

Plagiarism

The purpose of the MST125 assignments is to assess your understanding of the material taught, and your ability to apply it. This can be done only if the work that you submit is entirely your own.

Plagiarism is copying someone else's work without acknowledgement. It is a disciplinary offence and is taken very seriously by the University. You must work on each TMA and iCMA question on your own.

Note that in MST125 and in most other mathematics modules it is acceptable (and in fact often sensible) for you to copy the format of, and the words in, the examples and activities in the units. This is not considered to be plagiarism, as the mathematics in your work will be different from the mathematics in the unit. What you must not copy is someone else's solution to all or part of an assignment question.

You can find more advice on plagiarism in mathematics under the 'Developing good academic practice' link under the 'Assessment' area of the MST125 website. There is more general information on plagiarism in the *Assessment Handbook*. There is also a section on plagiarism on the OU Library's 'Being digital' website.

You must not post any assignment questions, or answers to them, on any internet sites or social networks, or advertise them for sale, as this constitutes a breach of copyright and/or the promotion of plagiarism.

Special circumstances

If at any stage you are having difficulty in completing an assignment, or if you anticipate that you will have problems in the examination, then your first step should be to contact your tutor to discuss what to do.

However, if serious circumstances beyond your control arise, which prevent you from submitting a TMA or iCMA, or result in you having to submit a TMA or iCMA that is incomplete or otherwise well below your usual standard, or affect your performance in the examination, then you should consider reporting these circumstances to the University, so that the MST125 Examination and Assessment Board can take them into account when it determines your overall result. For information about the sorts of circumstances that will be taken into account, how they will be taken into account, and how to report them, see the *Assessment Handbook*.

1.5 Studying MST124 and MST125 together

If you are studying MST124 and MST125 together, then the way in which you should prepare for and study the two modules depends on whether you are starting them at the same time or a few months apart. Please read the appropriate information below depending on your situation.

If you are not studying MST124 at the same time as MST125, then you can skip this subsection.

MST124 and MST125 starting at the same time

To successfully study MST124 and MST125 starting at the same time, you need a higher level of fluency with topics such as algebra, graphs, trigonometry, indices and logarithms than you need for starting MST124 alone. Starting both modules at the same time is recommended only if you are already very confident with these topics and you also have plenty of time for studying.

You should prepare for joint study of the two modules by working through MST124 Units 1 and 2 as soon as possible. You should find that you can get through the revision material in MST124 Units 1 and 2 fairly quickly, as it should mostly be very familiar to you. If you find that this is not the case, or if you find that the pace of study is hard to keep up with (you should be able to study the two units and complete their associated assignment questions within two weeks), then you should contact your OU Student Support Team as soon as possible, to discuss what to do. For example, you may be able to defer your study of MST125 to a later start date.

Throughout your joint study of MST124 and MST125, you should *not* study the units for the two modules on the dates shown on the main MST124 and MST125 study planners. Instead, you should study them on the dates given in the MST124 and MST125 joint study planner, which is available from the 'Resources' area of the MST124 and MST125 websites. This is important because you will not be prepared to study many of the topics in MST125 if you have not already studied the related topics in MST124. The joint study planner ensures that you study the units of the two modules interleaved in the correct order.

Note that MST125 Unit 1 *Key techniques* is not included on the joint study planner. This is because if you are studying MST124 and MST125 together then you do not need to study this unit at all. It covers revision of MST124, so you will meet the ideas in it as you work though MST124. You might find it useful to use all or parts of it for extra practice or revision later in your study of the modules.

The joint study planner directs you to study some of the MST124 units earlier than the dates shown on the main MST124 study calendar, and to study some of the MST125 units later than the dates shown on the main MST125 study calendar.

This means that you will be ready to complete some of the MST124 assignments earlier than students studying MST124 without MST125.

It is particularly important for you to aim to complete each MST124 TMA and iCMA within a few days of finishing the last unit covered in the TMA or iCMA, even if the cut-off date is later.

This is because the assignments are part of the learning process – they help you to consolidate your learning. Also, if you do not do this, then you may find that you have a lot of assignment work to complete for the two modules at around the same time.

Make sure that you do not forget to submit each TMA that you have completed early. Unfortunately, even if you submit a TMA early, you will not receive your marked work back early, as the University does not return marked TMAs until after the cut-off date.

You can submit each iCMA as soon as you have completed it. You will then immediately receive computer-generated feedback on your work.

Because you will be working ahead of some other students on MST124 for some parts of the module, some MST124 tutorials may cover topics at a later time than is ideal for you. Similarly some MST125 tutorials may cover topics at an earlier time than is ideal for you. So you will need to rely a little more on your own independent study than students studying the two modules separately.

MST124 and MST125 starting a few months apart

If you have chosen to study MST125 with a start date a few months later than the MST124 start date, then you should be able to study both modules in the same way as students studying them completely separately, following the individual MST124 and MST125 study planners on the module websites.

The only difference is that you should not study the whole of MST125 Unit 1 when scheduled to do so. You might wish to study Sections 1 to 4 of this unit during the allocated weeks, as revision of topics that you have covered in MST124, and allow additional time in your plans to study Sections 5 and 6 before you study MST125 Unit 7, *Topics in calculus*.

You should also take particular note of the assignment cut-off dates, as they may occur at around the same times for the two modules. Make sure that you plan enough time to complete each assignment.

1.6 Support for your studies

You are not alone when studying MST125. Support is available from your tutor and other students, through face-to-face or online tutorials, and via the MST125 website, as explained below.

If you experience difficulties that are not directly related to the content of MST125, then you should contact your Student Support Team – see your StudentHome page for details.

Support from your tutor

You will be assigned a tutor (also known as an associate lecturer or AL) for MST125. Your tutor's details will appear on your StudentHome page shortly before the MST125 start date. You will be one of about twenty students in a tutor group.

Your tutor will probably contact you during the first few weeks of MST125. Alternatively, you may like to make the first contact, by sending an email. Your tutor will be delighted to hear from you. You may like to tell him or her a little about your previous mathematical studies, or why you decided to study MST125.

Your tutor is there to help you with any mathematical problems that you encounter, and he or she can also provide advice on other matters related to your progress, such as study skills, how to write mathematics well and what to do if you are worried about completing a part of the module in time. Your tutor will also mark your TMAs, and provide feedback on them to help you improve your work.

Tutors offer face-to-face tutorials, or online tutorials or a mixture of both. There is a link to the room for online tutorials in the 'Tutorials' area of the MST125 website, and further details about using it are given in Subsection 2.6.

Although tutorials are optional, you are encouraged to attend them if you possibly can. Seeing a tutor explain ideas and techniques in his or her own way, with the opportunity for you to ask questions, will usually improve your understanding and consolidate your learning. Tutorials also provide an excellent way for you to sort out any mathematical problems that you have, improve your preparation for the assignments and the examination, and get to know the tutor and other students.

Shortly after the tutorial timetables have been decided, you will have access to the tutorial booking system in the 'Tutorials' area. Click on the link 'Your tutorial and study event'. From here you can choose which tutorial you would like to attend. These can be sessions run by your own tutor and/or other tutors in the area.

OU tutors are extremely dedicated people who want to help you with your studies, so don't hesitate to contact your tutor for help or advice. Your tutor will tell you when and how it is best to contact him or her. Some tutors will give preferred times to be called by phone. Your tutor will usually read and respond to OU email at least twice a week, when not on leave. Please have reasonable expectations of your tutor: tutors want to help you, but most work for the OU for only a small proportion of their time.

Please note that your tutor may not be familiar with all three of the mathematical typesetting systems that you can choose to study in MST125, and he or she is not required to provide complete support for this element of the module. For each of the three systems, there is a dedicated online forum (see below for general information about online forums). You can post any queries that you have about mathematical typesetting to these forums, where they will be answered by other students or by the forum moderators, who are tutors familiar with the relevant typesetting systems. You are also welcome to seek help from your own tutor about mathematical typesetting, but, depending on your query, he or she may have to refer you to the forum.

Support from other students

You have access to online forums where you can discuss MST125 with other students. You and the other students can use these forums to help each other, by asking and answering questions, and by suggesting study tips. Trying to explain an idea to someone is often an excellent way of improving your own understanding. You should also find it interesting and reassuring just to see how other students are getting on with MST125.

You can use the forums to discuss all aspects of MST125, and other issues related to your studies, but you must not discuss answers to TMA or iCMA questions. Please do not state your assignment scores in the forums, as students who did worse than you may be discouraged, or think you are boasting. It is fine to say that you are pleased or disappointed with your score.

The forums are monitored by one or two MST125 tutors, who will intervene if inappropriate or incorrect messages are posted. Please always communicate on the forums in a reasonable manner, to help maintain them as a friendly, supportive environment where everyone can participate without fear of being ridiculed, abused or upset.

In your use of the forums you are expected to abide by the OU Computing Codes of Conduct (available via the OU Computing Guide). On the rare occasions that a person's behaviour becomes unacceptable, the University will exclude that person from the University network.

For information on how to access and use the online forums, see Subsection 2.5.

Support from the OU Library

As a registered student you can access the wide range of online resources provided through the OU Library's subscriptions. See the 'Library resources' link in the 'Resources' area on the MST125 website for links to some resources that may be helpful. If you need help with any of these resources, then you should contact the Library Helpdesk by phone, email or webchat. The contact details are on the OU Library website.

1.7 How to study

This subsection suggests some ways of studying that may help you succeed with MST125. Different people have different approaches to study, and what works best for you may be different from the suggestions here.

All studying takes time and effort, and distance learning also demands a great deal of organisation and self-discipline. Being self-disciplined about your use of time is the key to developing good study habits, and to not getting overwhelmed by the different tasks and assignment deadlines.

You need to identify times during the week when you can study productively, and times when you cannot, due to other commitments. You may have to reduce some of your regular commitments or delegate some chores to others to make time for study. You may also need to negotiate with friends and family to ensure that you have enough time for your studies.

Try to study in a place that is away from distractions, and close to where you can keep all your study materials and the computer that you will be using for MST125.

How to read a unit

You will gain most benefit from your study if you engage with the text as you read it. You should study the text with a pen or pencil, and paper, to hand, making your own notes as you go along. As mentioned earlier, you should try to make sure that you understand each step of an explanation or an example, and how it follows from the previous steps. You might like to try to anticipate what the next line of an example might be. You should attempt each activity in the unit, writing out your solution and perhaps annotating it with brief notes about anything that you first got wrong but then corrected, or found difficult but then resolved. Writing out your solutions will give you useful practice in writing mathematics, and you can refer to them when you do assignment questions and when you revise for the examination.

The secret of good note-taking is to achieve a sensible balance between length and detail, so that you note the important facts and not too much unimportant detail. It is sometimes not easy to decide what is important, but most people will want to make notes about new definitions, new symbols and notation, and important theorems and techniques. Your notes might include lists, worked examples and diagrams. You might find it helpful to annotate the unit texts themselves.

Try to organise your solutions to activities and your other notes in a way that makes it easy to refer to them later. For example, you might use a ring binder or a notebook.

Don't forget that you can use the practice quizzes and exercise booklets for additional practice in the techniques in some units.

How to approach a mathematical problem

Throughout MST125 you will need to solve mathematical problems, both in the activities in the units and in assignment questions. Here are some suggestions of how to approach these.

When you are faced with a written question or problem to solve, you should first read it carefully, making sure that you understand exactly what is required. You may find it helpful to underline or highlight some parts. It is important that you get to grips with the question in two ways: first, absorb the information given, and, second, find out what the question is really asking. This way of analysing a question can be summarised by the following questions.

- What do I know?
- What do I want?

Your solution should link these.

Try to decide not only what you know from the question itself, but also which of the facts and techniques that you already know might help with the problem. If the problem is about a practical situation, then you have to start by translating it into a mathematical form. It might help to draw a diagram or a graph, or use a formula that you know, or all of these.

When you consider what you want, you should first decide whether you have to find an answer or show that something is true. If you do not take the time to do these things, then you may end up not really answering the question, or may get unnecessarily stuck.

If you're not sure how to solve the problem, try to find similar examples and activities in the module texts, if possible. Use these for ideas, but think carefully about how your problem differs from the ones in the text.

Once you have some ideas for a solution, try to write out your thinking as clearly as possible, so that you can easily understand each step and why it follows from earlier steps. You may find that leaving the problem for a while and then coming back to it helps you to see things more clearly. If you do this, then make sure that you have written down what you have done so far.

When you have found a solution, you should check your answer, ideally by using a different method. Also, check that your answer makes sense in the context of the problem.

When you write out your solution to a TMA question, remember that you are trying to communicate with your tutor. There is guidance on how to communicate mathematics in Unit 1 of MST124, which is available from the MST125 website. In each MST125 TMA some marks are allocated for how well you have done this. Remember that the solutions to the examples and activities in the study texts are examples of good mathematical communication, and can be a useful guide to what and how much to write.

What to do when you are stuck

Getting stuck with mathematics sometimes is inevitable – it happens to us all. You might get stuck when trying to understand something in a unit, or when trying to do an activity or an assignment question. When you are stuck, it is often worth spending a few minutes trying to resolve it yourself – if you can, then you are likely to learn from the process, and you should remember what you have learned more easily in future. It may help to look back at the material that led up to that point, and make sure that you fully understand it. If are trying to do an activity or assignment question, then try looking back at the relevant unit, or your notes, to find a similar example, if you have not done so already. Think also about whether any of the facts and techniques that you learned earlier in your mathematical studies might be helpful. Sometimes it can help to take a break, and come back refreshed. Sometimes it is useful to discuss the issue with someone – the act of explaining exactly why you are stuck can be enough to help you resolve the problem.

You should not spend a large amount of time puzzling over a particular point without making progress, however. Many difficulties can be resolved rapidly with help from your tutor or other students, leaving you more time to get on with the rest of the unit or assignment. Ways to obtain such help, and other support, from your tutor and other students were described in Subsection 1.6.

1.8 Learning outcomes

Every Open University module has a set of **learning outcomes**. These are statements of what a student is expected to know, understand and be able to do at the end of the module. The overall learning outcomes for MST125 are as follows. Some of the words may not mean much to you at this stage, but you should understand them all after you have completed the module. More detailed learning outcomes are given at the end of each unit.

Learning outcomes for MST125

Knowledge and understanding

- Understand some properties of different types of numbers, modular arithmetic, conics, hyperbolic functions, simple geometric transformations and eigenvalues/eigenvectors.
- Understand the basic principles of mathematical proof.
- Understand and apply the ideas behind some mathematical methods, including those applicable to recurrence sequences, curve-sketching and first-order differential equations.
- Understand and work with basic ideas in modelling forces and motion.

Cognitive skills

- Choose appropriate strategies for problem solving, in both practical and abstract contexts.
- Use moderately complicated mathematical techniques.
- Understand texts involving moderately complicated mathematics.

Key skills

- Work fluently and accurately with some standard mathematical techniques, in particular those of basic calculus.
- Use the techniques of mathematics to model and solve simple mechanical problems.
- Communicate mathematics effectively in writing.
- Use a mathematics computer package.
- Study independently.

Practical skills

- Think logically about problems and apply relevant techniques, including use of a computer, to a variety of situations.
- Work on tasks independently, and manage time.

1.9 Queries and how to contact the OU

The best way to contact the OU for almost all sources of help is via the links in StudentHome.

In all contact with the University, you should give your name and student number (personal identifier, PI) and the module code (which is MST125). In any emails that you send via StudentHome, your name and PI are included automatically. If your query is specifically about the content of MST125, please note the contact details given in Table 4.

Table 4 Contact details for MST125 issues

Problem	Whom to contact
Clarification and/or help on any of the MST125 materials, queries about assignments or suspected errors	Your tutor in the first instance, or the MST125 forum.
Problems with *using* the computer algebra system	Your tutor in the first instance, or the MST125 forums.
Problems with *using* the mathematical typesetting systems	Your tutor, or the appropriate MST125 typesetting forum. Your tutor may refer you to the forum.
Problems with *installing* the computer algebra system or the mathematical typesetting systems	The OU Computing Helpdesk (via the link in the OU Computing Guide).
General problems with using your computer for OU study, or with OU online services	Check the OU Computing Guide in the first instance, or contact the OU Computing Helpdesk (via the link in the OU Computing Guide).

The OU Computing Helpdesk provides technical support for OU-provided IT services and applications, including online forums and tutorials, problems with usernames or passwords, and access to websites and other online facilities. It does *not* provide help with system or hardware queries (such as questions about your internet connection, or installing hardware or operating systems).

When you contact the Helpdesk it will help to resolve your query quickly if, as well as giving your student number and module code (MST125), you can supply detailed information about the problem that you are experiencing, including the full text of any error messages, and which operating system your computer has (such as Windows Vista, 7, 8 or later).

2 Technology guide

This section provides information that will help you to use the computing and online components of MST125. These components include the tutorial clips, videos, applets, interactive computer-marked assignments (iCMAs), practice quizzes and several computer-based tools that you can use to communicate with your tutor and other students.

You might find it useful to skim through this section now, to get an idea of the sort of information that it contains, and then refer back to it as necessary. Any updates to the information given here will be provided via the MST125 website.

If you need further help with any of the computing and online components of MST125, then see the contact list in Subsection 1.9.

2.1 Computing safely

Since you will need to use your computer quite a lot for MST125, it is worth ensuring that you have set up a comfortable computer workstation, to avoid wrist, back and eye problems. There is information on how to do this, and some guidance on good working practice, in the 'Using a computer' section of the online OU Computing Guide.

You should avoid sitting at your computer for long periods of time without a break.

You should ensure that you have minimised the risk of your computer becoming infected by computer viruses, and the risk of other computer attacks. There is information on how to do this in the OU Computing Guide.

2.2 Applets

The MST125 applets are small interactive computer applications, as described in Subsection 1.3. You can access them from the MST125 study planner.

To access and use the applets you need a web browser that supports a technology known as HTML5. Suitable web browsers include recent versions of Firefox and Chrome, and Internet Explorer version 9 or later. Note that Internet Explorer version 9 is available only for Windows Vista, Windows 7 and later versions of Windows – in particular, it is not available for Windows XP. The applets also work on many mobile devices.

Most of the applets were created using software called GeoGebra. You will see the GeoGebra logo when they load.

Detailed instructions for using each applet are displayed on the same web page as the applet, and you can click on the help button for more information. If you have trouble using the interactive controls in an applet, perhaps because you are using a touch screen or because of a disability,

then try the alternative controls that appear when you click 'Show accessibility controls'. If you have further difficulties with using the applets, because of a disability, then see the advice in Section 3, Accessibility guide.

You can download the applets to your computer, to use offline, from the MST125 website.

2.3 Tutorial clips and videos

The tutorial clips and videos were described in Subsection 1.3. You can access them from the MST125 study planner.

To hear the audio of the tutorial clips and videos you need to have speakers or headphones connected to your computer.

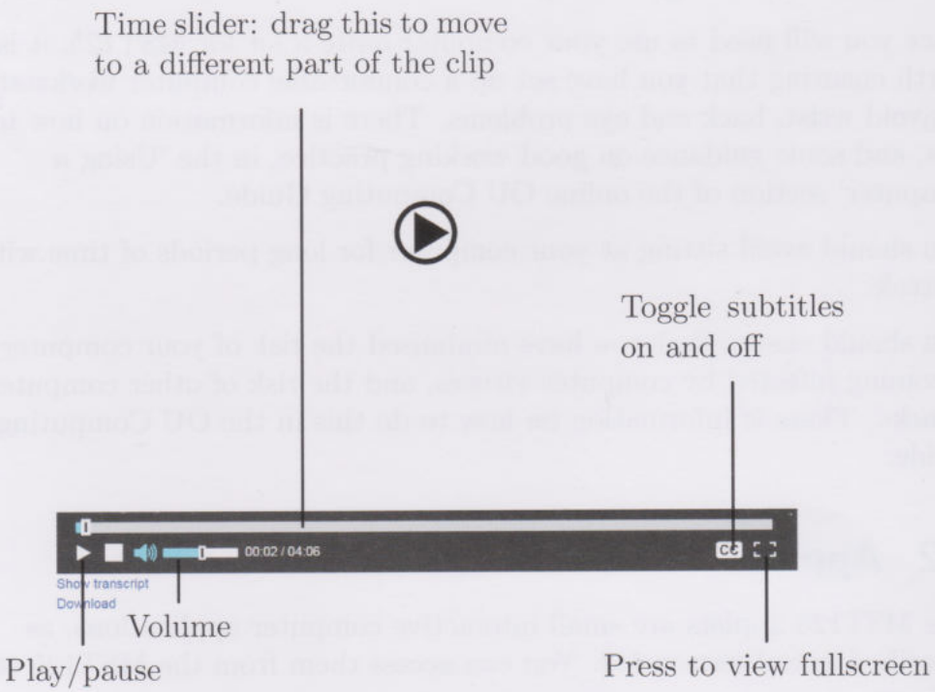

Figure 5 Video player window for tutorial clips and videos

To play a tutorial clip or video, click on the large play button in the centre of the video player window, or the smaller play button on the control bar at the bottom. While the tutorial clip or video is playing, the play button on the control bar changes to a pause button – you can click this to pause the play. The other controls are shown in Figure 5. Note that if you turn the subtitles on or off, your choice will automatically be applied to all the other MST125 tutorial clips and videos.

You can download a tutorial clip or video to your computer, to use offline, by using the 'Download' link below the video player. Alternatively, you can download batches of tutorial clips from the MST125 website.

2.4 Practice quizzes and iCMAs

The practice quizzes and iCMAs (interactive computer-marked assignments) were described in Subsections 1.3 and 1.4, respectively. You can access them from the online MST125 study planner. You can also access the iCMAs from the 'Assessment' area of the MST125 website.

You need to be online while you are working on a practice quiz or iCMA, but you do not have to complete it in a single session – you can leave it and return to it as many times as you like.

Practice quizzes

Figure 6 shows a typical practice quiz question. The question is on the right, with, in this case, a box in which to input your answer. On the left there is a navigation panel containing the numbers of all the questions in the quiz. You can click on one of the question numbers to move to that question. If you click on the 'i' at the top left of the navigation panel then you will see a page of instructions for the quiz. This page of instructions also appears when you first open the quiz, and you should read it carefully before starting the first question.

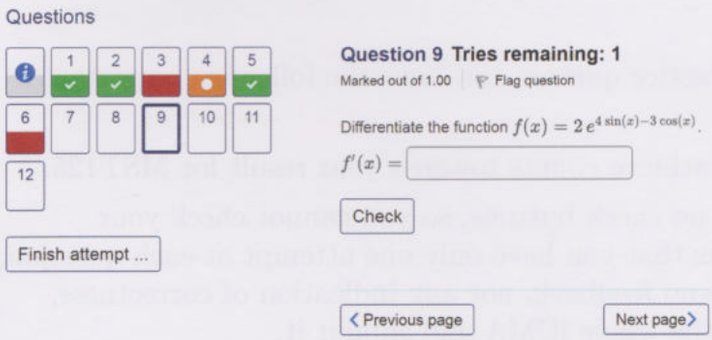

Figure 6 A practice quiz question, with the navigation panel on the left

There is information on how to input your answers later in this subsection.

After you have input your answer to a question, or all of your part-answers in the case of a question with more than one part, click the 'Check' button. You will then receive computer-generated feedback. If your answer, or any of your part-answers, was incorrect, then you can click the 'Try again' button for another try. You are allowed three attempts at each question.

After your third attempt at a question, or after an attempt in which your answers to all parts of the question were correct, a worked solution will be displayed and the lower half of the question number box in the navigation panel will be marked as follows.

- Green shading and a tick indicates that your final answer was correct.
- Amber shading and a circle indicates that some part-answers were correct and others were incorrect.
- Red shading indicates that your final answer was incorrect.

You can click the 'Next' button to move to the next question, or choose a different question from the navigation panel.

All the answers that you input, whether you checked them or not, are automatically saved when you move to another question. You can change your answers to a question at any time before you click the 'Check' button.

While you are working on a quiz it is best *not* to use the back or forward buttons of your web browser, as this may cause errors. Use the navigation panel instead.

When you close the quiz, all your saved answers are retained for your next session. When you return to the quiz, start by clicking the 'Continue last attempt' button.

When you have completed a quiz, a page containing a summary of what you have done will be displayed. If you want to finish a quiz without completing it, click the 'Finish attempt ...' link under the navigation panel, which will take you to the summary page. From the summary page you can click the 'Submit all and finish' button to end the quiz. Alternatively, if you have not completed the quiz, you can click the 'Return to attempt' button to continue working on it. If you click 'Submit all and finish', then you will not be able to return to the quiz, but you can start it again, and usually the questions will be different.

iCMAs

iCMAs are similar to practice quizzes, but have the following important differences.

- The score that you achieve counts towards your result for MST125.
- The questions have no check buttons, so you cannot check your answers. This means that you have only one attempt at each question, and you will receive no feedback, nor any indication of correctness, until you complete the whole iCMA and submit it.
- You cannot start the iCMA again once you have clicked the 'Submit all and finish' button. So you have only one attempt at the iCMA.
- When you have answered all parts of a question, the lower half of the question number box in the navigation panel is shaded grey.

You can leave an iCMA and return to it as many times as you like, and you can change your answers as many times as you like, until you click the 'Submit all and finish' button.

Make sure that you read the important information on iCMAs in Subsection 1.4.

Remember!

- Don't click the 'Submit all and finish' button until you are satisfied with all your answers to all the questions.
- Click the 'Submit all and finish' button by the cut-off date at the latest.

Inputting answers in practice quizzes and iCMAs

For most questions, you have to input answers that are numbers or algebraic expressions.

To input a number, just type it, using a full stop for a decimal point if you need one. *Do not include any units, nor any indication of rounding.*

To input an algebraic expression, use the syntax in Table 5. In particular, you should use `*` to indicate multiplication. For example, you must enter xy as `x*y`, not `xy`. If you omit a `*`, then in some cases the system will interpret your answer correctly, but in other cases it may not.

The input syntax is case-sensitive, so, for example, the variable X will be interpreted as different to the variable x.

Note that, for trigonometric functions, angles are in radians, not degrees. Also in Table 5 the letter i denotes an imaginary number whose square is -1.

The symbol used for powers (^) is obtained by pressing `Shift` and `6` on a standard computer keyboard.

You often have to include several pairs of brackets to input an algebraic expression correctly. For example, to input

$$\frac{3x^{1/3}}{4+\sqrt{2}}+3,$$

you should type `(3*x^(1/3))/(4+sqrt(2))+3`.

As you input your answer, it will be displayed as correctly formatted mathematics, so you can check that it is as you intend. *Make sure that you check this carefully.*

There are further details about practice quizzes and iCMAs in the online OU Computing Guide, under 'iCMA (interactive Computer-Marked Assignments)'.

Table 5 Syntax for answers to practice quiz and iCMA questions

Mathematics	Input syntax	Example
Addition	`+`	`x+y`
Subtraction	`-`	`2-z`
Multiplication	`*`	`2*x+x*y`
Division	`/`	`x/3`
Equals	`=`	`y=m*x+c`
Brackets	`(` and `)`	`(2+x)*(x-3)`
π	`pi`	`2*pi`
e	`e`	`3*e`
i	`i`	`2*i+3`
Power	`^`	`x^2`
Square root	`sqrt`	`sqrt(2)`
e^x	`e^x` or `exp(x)`	`e^3` or `exp(3)`
Natural logarithm, ln	`ln` or `log`	`ln(5)` or `log(5)`
$\|x\|$	`abs(x)`	`abs(-3)`
sin, cos, tan	`sin`, `cos`, `tan`	`sin(pi/5)`
$\sin^2 x$, $\cos^2 x$, $\tan^2 x$	`sin(x)^2`, `cos(x)^2`, `tan(x)^2`	`sin(x)^2-cos(x)^2`
sec, cosec, cot	`sec`, `csc`, `cot`	`sec(pi/4)`
$\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$	`asin`, `acos`, `atan`	`asin(0.5)`

2.5 Online forums

The MST125 forums are online group discussion areas where you can post messages to be seen and replied to by other students and sometimes by tutors. You can find them in the 'Forums' area at the top of the MST125 website.

When you visit a forum you will see a list of topics that are being discussed. To read a discussion, click on the topic. You can then reply to any of the messages on that topic. To start a new topic, press the 'Start a new discussion' button above the list of current topics.

You can choose to have all the new messages that are posted to a forum also emailed to your preferred OU email account. To opt into receiving these emails, click 'Subscribe to forum' at the top of the main forum page. To opt out of receiving them, click 'Unsubscribe', which is displayed only if you have opted to receive them.

There is more information on online forums in the online OU Computing Guide, under 'Forums'.

Mathematics in forum messages

You can include properly formatted mathematics in your forum messages, if you want. To do this, you type the mathematics using special syntax, which is taken from the LaTeX mathematical typesetting system. You should enclose this syntax between two double-dollar signs; that is, between `$$` and `$$`. For example, to include the expression $3x + 2$ properly formatted in your message, type `$$3x+2$$`.

Alternatively, first display the full set of message editing tools by clicking the 'Toolbar Toggle' button, which is

and is the left-most button on the message editing toolbar shown in Figure 7 below.

Figure 7 The message editing toolbar

Then, at the point where you want to include mathematics in your message, click the 'Insert equation' button, which is

This will open the 'Insert equation' window (see Figure 8). Type the syntax in the box (in the page headed by the 'TeX' tab), *without* the `$$` signs. As you type, a preview of the formatted mathematics is displayed. Once you are satisfied with it, click 'Insert' to include the mathematics in your message.

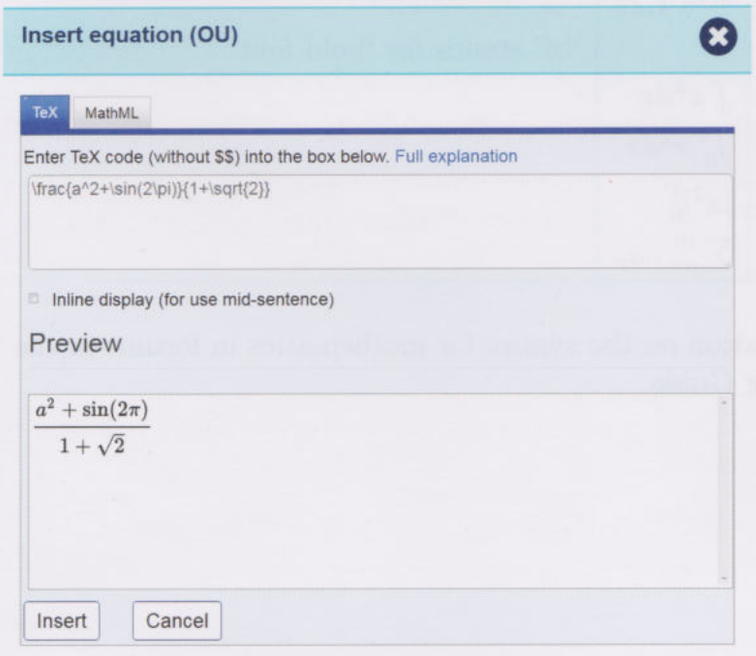

Figure 8 The 'Insert equation' window

Some examples of LaTeX syntax and the corresponding output are given in Table 6. The syntax includes many special commands, most of which have names that start with the backslash character \. Some commands are complete in themselves, whereas for others you have to include one or more objects for the command to 'act on'.

To group a string of characters into a single object, enclose the string in curly brackets, { and }. For example, to obtain x^{12}, type `x^{12}`. If instead you type `x^12`, then you obtain $x^1 2$, because the 1 and 2 were not grouped as a single object.

It is often useful to enclose even a single character in curly brackets, to specify that it is an object for a command to act on. For example, to obtain $\sqrt{x}$, type `\sqrt{x}`.

You will learn more about the LaTeX syntax for entering mathematics if you choose to learn the LaTeX typesetting system in Unit 2.

Table 6 Syntax for mathematics in forums

Input	Output	Notes
`\alpha`	α	To obtain any Greek letter,
`\pi`	π	type its name preceded by \
`x^{12}`	x^{12}	
`x_1`	x_1	
`\sqrt{2}`	$\sqrt{2}$	
`\frac{a+b}{c+d}`	$\frac{a+b}{c+d}$	
`2 \times 3`	2×3	
`\sin x`	$\sin x$	To obtain other common functions,
`\ln x`	$\ln x$	type their names preceded by \
`x \approx 1.27`	$x \approx 1.27$	
`\mathbf{v}`	$\mathbf{v}$	'bf' stands for 'bold font'
`\int x^2 dx`	$\int x^2 dx$	
`\int_0^1 x^2 dx`	$\int_0^1 x^2 dx$	
`[x^2]_0^1`	$[x^2]_0^1$	
`\sum_{n=1}^{10}a_n`	$\sum_{n=1}^{10} a_n$	

There is more information on the syntax for mathematics in forums in the online OU Computing Guide.

Netiquette

When using the online forums, please follow appropriate online etiquette, known as *netiquette*, as outlined below.

Netiquette is the unwritten rule book for good behaviour online. Although the principles are similar to those for face-to-face conversation, the limitations of a text-based medium mean that you have to learn some new techniques. Other people can't see the expression on your face or hear your voice, so it is what you write that sets the tone of the conversation. It is best to adhere to the following ground rules.

Thank, acknowledge and support people

People can't see you nod, smile or frown as you read their messages. If they get no acknowledgement, they may feel ignored and be discouraged from contributing further. Why not send a short reply to keep the conversation going? However, do bear in mind that in a large, busy forum, too many such messages could become a nuisance.

Acknowledge before differing

Before you disagree with someone, try to summarise the other person's point in your own words. Then they will know that you are trying to understand them and will be more likely to take your view seriously. Otherwise, you risk talking *at* each other rather than *to* each other.

Make your perspective clear

Try to avoid speaking impersonally: 'This is the way it is ...', 'It is a fact that ...'. This will sound dogmatic and leaves no room for anyone else's perspective. Why not start with 'I think ...'? A common abbreviation is IMHO (in my humble opinion) – or even IMNSHO (in my not so humble opinion). If you are presenting someone else's views, say so, perhaps by a quote and acknowledgement.

Emotions

Emotions can easily be misunderstood when you can't see faces or body language. People may not realise that you are joking; irony and satire are easily missed. Smileys or emoticons such as :-) and :-(can be used to express your feelings (look at them sideways). Other possibilities are punctuation (?! #@*!), < grin > or < g >, < joke > or #joke.

Be aware of your audience: people from widely differing cultures and backgrounds may read what you write online. What you find funny may be offensive to them.

DON'T WRITE IN CAPITALS – IT WILL COME OVER AS SHOUTING!

Flaming

If you read something that offends or upsets you, it is very tempting to dash off and submit a reply – but don't! Online discussion seems to be particularly prone to such 'flames', and things may escalate in a flaming

spiral of angry messages. So if you feel your temperature rising, take a break or sleep on it before replying.

It may help to read the message again and think about whether it is possible to interpret it in a more positive light. You can often interpret a message in more than one way. It can be a very useful tactic to always assume that a message is meant positively, if at all possible. This can help to prevent a spiral of angry messages developing, whereas the opposite assumption can have the opposite effect.

Additional advice

- Keep to the subject, and pick the right topic for your contribution.
- Before you write a message, take time to see what is being discussed, and how.
- Keep messages short.
- Write a good subject line (title) for your message – people often haven't time to read messages unless the subject line looks relevant.
- Keep to one subject (one topic of discussion) per message.
- When replying to a message, quote part of the earlier message only if you need to. Don't include everything, or messages get longer and longer.

Remember that you should not include details of solutions to assignment questions in forum messages, but it is acceptable to give advice to point other students in the right direction. For example, you can give a reference to an appropriate part of a unit.

2.6 Online tutorial rooms

Your MST125 tutor may provide online tutorials instead of, or in addition to, face-to-face ones. These will take place in online 'rooms'.

Online rooms allow two-way communication using audio and text messaging, and the use of a shared on-screen whiteboard.

You can access the online rooms from the 'Tutorials' area at the top of the MST125 website.

To use an online room you will need the following.

- A computer connected to the internet.
- Headphones to listen to your tutor and other participants. Alternatively, you can use speakers, but they can to lead to sound problems when used at the same time as a microphone.
- A microphone to enable you to speak to your tutor and other participants. A combined headphone/microphone headset is recommended. You can participate in an online tutorial without a microphone, since you can communicate by text messaging, but it is best to have a microphone so you can participate fully.

There are further details of how to use the online rooms and configure your computer for online tutorials in the online OU Computing Guide.

You should check that your computer is suitably configured, and test the system, several days before your first online tutorial.

2.7 OU Anywhere

If you have a smartphone or tablet with an iOS or Android operating system, then you can download the tutorial clips and videos, and electronic versions of the units, to your device by using the OU Anywhere app. You can download this app from the app store in the usual way.

There are further details in the OU Computing Guide.

3 Accessibility guide

This section is primarily aimed at those who may have difficulties with one or more elements of MST125 because of a disability, for example.

Mathematics is a visual subject involving the use of mathematical notation, graphs and diagrams. General accessibility advice for all mathematics modules is available in the online document 'Accessibility for mathematics and statistics modules', which you can find in the 'Accessibility' section in the 'Resources' area of the MST125 website. You are advised to read this document carefully. It outlines the general accessibility options for module materials and websites, and contains advice on presenting your mathematics and completing the assessment.

This section of the MST125 *Guide* provides further accessibility advice specifically related to MST125. The 'Accessibility' section also contains other accessibility resources related to MST125, including updates to this section of the MST125 *Guide*, and useful web links.

Although the Open University has tried to avoid using inaccessible resources in MST125, and to provide accessible alternatives where possible, some material that is core for MST125 may not be easily accessible, even if you use assistive technology. You may need a non-medical helper to assist you.

If you think that you may need additional support during your study of MST125 and you have not already contacted the University about this, please visit the 'Disabled support services' website (available from your StudentHome 'Help Centre'). It describes the range of support services that are available, and guides you through the procedure to request extra help. Alternatively you can discuss your needs with an adviser from your Student Support Team. You can use the link in the Help Centre on your StudentHome page to find its contact details.

3.1 Components of MST125

Printed materials

You can find the latest information about the different accessible formats available for the MST125 materials on the 'Disabled support services' website from StudentHome via your StudentHome 'Help Centre'. Searchable PDF versions of printed material are available from the 'Resources' area of the MST125 website, and figure descriptions of the diagrams, graphs and images are available from the 'Accessibility' section within the Resources area. However, mathematical content in PDF files is unlikely to be accessible using a screen reader.

Applets

Many of the applets contain dynamic graphs and other diagrams that are not accessible to screen readers. If you have difficulty with viewing these diagrams and reading the text on them, then you may wish to consider the services of a non-medical helper.

Each applet has a 'Show accessibility controls' button. Clicking on this button reveals controls that enable you to change the thicknesses of lines and the colours used in the applet. It also reveals controls that you can use to interact with the applet, as alternatives to some of the default controls.

Tutorial clips and videos

The tutorial clips and videos have been subtitled. You can then turn the subtitles on or off using a button on the video player control bar. Written transcripts are available from a link below the video player.

Practice quizzes

The practice quizzes can be read by a screenreader.

Computer algebra system (CAS)

An important part of studying MST125 is learning how to use a computer algebra system. Guidance on the accessibility options for this software is given in the *Computer algebra guide*.

Unit 2: Mathematical typesetting

In Unit 2 you have the choice of which of three mathematical typesetting systems to learn. If you interact with your computer by keyboard alone, or have visual impairments, then we recommend that you choose to learn the LaTeX system. There is more information on the accessibility of mathematical typesetting in the 'Accessibility for mathematics and statistics modules' document on the MST125 website.

Computer-based learning

Table 7 summarises the number of applets, the number of activities that use them, the number of tutorial clips, and the number of activities that use the computer algebra system (CAS) in each unit of MST125 is available from the 'Accessibility' section of the MST125 website. This should help you to plan when you might need to allow extra time for a unit, or when you might need the assistance of a non-medical helper.

Note that Unit 1, *Key techniques*, includes the study of an extensive section of the *Computer algebra guide* revising the key CAS techniques that you learned in MST124, and Unit 2, *Mathematical typesetting*, requires the continuous use of a computer.

Table 7

Unit	Applets	Activities using applets	Tutorial clips	Activities using CAS
1	0	0	0	1
2	0	0	0	0
3	0	0	12	1
4	6	6	6	4
5	0	0	7	0
6	2	4	11	0
7	0	0	17	3
8	0	0	4	1
9	0	0	10	0
10	0	0	10	0
11	1	1	4	1
12	1	1	11	1

3.2 Assessment

The assessment in MST125 that counts towards your final result consists of tutor-marked assignments (TMAs), online interactive computer-marked assignments (iCMAs) and an exam.

The TMAs are in PDF format, and descriptions of graphs and diagrams are supplied. You should be able to complete the TMAs successfully with appropriate support from your tutor or helper.

The iCMAs are submitted online and may have some interactive content. Like the practice quizzes, the iCMAs can be read by a screenreader.

If you have informed the University that you have additional requirements for the examination, then you will be contacted by a study adviser to discuss any special arrangements that you need.

If you have additional requirements for the examination and have not informed the University, then it is important that you do so as soon as possible. You will need to contact your Student Support Team.

If you are unable to submit all your assignments, or have difficulties during your revision or examination, then you are advised to report these special circumstances. Further details are given in the *Assessment Handbook*.

3.3 Studying MST125 without internet access

Studying MST125 without access to the internet is not permitted except in special situations, such as for students in prisons and other closed institutions.

If you are a student in such an institution, then the Open University Students in Secure Environments (SISE) team, along with your own local education officers, will help manage your access to the module materials, and the submission of your assignments.

If you are permitted to study MST125 without internet access, then as well as the usual printed materials, you will receive an *Offline resources* disc, containing the applets, tutorial clips, videos and exercise booklets. This disc also contains practice quiz booklets, which are sets of further practice questions similar to those in the online practice quizzes.

It is not possible to provide offline versions of the practice quizzes or iCMAs.

In place of each iCMA you will receive an assignment that contains multiple-choice questions on the same topics as the iCMA questions.

Appendix: further information

The sources of further information mentioned in this MST125 *Guide* are listed below. The name of each resource is followed by a sequence of links leading to the resource, or a URL, or both. Any updates to this information will be provided on the MST125 website.

OU resources

StudentHome
`www.open.ac.uk/students`

MST125 website
StudentHome → MST125 Module Website

Study at the OU (MST125 page)
`http://www.open.ac.uk/courses/modules/mst125`

Skills for OU Study
StudentHome → Help Centre → Study skills
`http://www2.open.ac.uk/students/help/topic/study-skills`

OU Computing Guide
StudentHome → Help Centre → Computing help
→ Using OU systems → Computing Guide
`www.open.ac.uk/computingguide`

Mathematics and Statistics undergraduate programme site
`learn1.open.ac.uk/site/maths-stats`

Being digital (OU Library resource)
`www.open.ac.uk/libraryservices/beingdigital`

OU Library
`www.open.ac.uk/library`

Assessment Handbook
StudentHome → Help Centre → Assessments and exams
→ Assessment handbook

Services for disabled students
`www.open.ac.uk/disability`

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Unit 2 Mathematical typesetting (Provided as a separate item)
Unit 3 Number theory

BOOK B

Unit 4 Conics
Unit 5 Statics
Unit 6 Geometric transformations

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Unit 7 Topics in calculus
Unit 8 Differential equations
Unit 9 Mathematical language and proof

BOOK D

Unit 10 Dynamics
Unit 11 Eigenvalues and eigenvectors
Unit 12 Combinatorics

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